Structural Limitations with K Means Algorithms in Research in Perú

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***Abstract*—In the world of science there are high-level, moderate-level, and low-level emerging countries. The indicators are an investment in research and development (I&D), number of universities, investment, researchers, intellectual production, expenditure on education, gross domestic product (PBI), and quality of life (IDH). In Methodology, it is basic, explanatory, of conglomerates. There are 37 countries analyzed. The data comes from the FMI, datosmacro.com, UNESCO, URWU. There are 11 indicators. These are data taken in two stages, 2006 and 2019. The Results shows R2= 0.9887, which explains the behavior of the PBI by the investment in I&D. The positive and significant relationship between IDH and PBI per capita, which is 0.824, is transcendent. In conclusion, there are three clusters with clearly differentiated indicators. Peru's problem is structural in that it does not have a per capita PBI of $ 30,000 per person or more. Investment in I&D in Peru is low and PBI is also low. Therefore, countries with higher investments in science have high PBIs and better IDH.**

***Keywords*—Researchers; PBIpc; investment in I&D; exports; universities**

I. Introduction

One thing that sets developed countries apart from non-developed countries in science and technology. This is what Francisco Sagasti, current president of Peru, reminds us [1] today, the production of vaccines against COVID 19 can only be produced by countries called "rich"? So should the long-term vision of Latin or African countries be rethought? The capacity of researchers? Resources for Research? And above all, the will of the state to achieve quality-of-life goals for its citizens? Underdevelopment and dependence are related [2] In the same way PBI and scientific production are related [3]. This document leads us to specify data and strategies to help us reflect on what needs to be done within the framework of social welfare.

The lack of vaccines shows the reality of the Peruvian state, the health crisis, the scientific infrastructure to confront the disease. The concept of a failed state was pointed out by the Ombudsman, who said, "the state is not up to the needs of Peruvian citizens" [4].

The experience of rapid testing revealed that not only was there no science, but strategic confusion to deal with evil. By failing to detect asymptomatic, rapid tests announced that only 2% of them had COVID [5].

Today there is a conviction that if there are no vaccines, the economy can't be reactivated. China demonstrates this growth in 2020 by 2%; the world has recessed by -4.5%. Some countries face quickly and effectively, as of April 7, 2021, the portal [6] notes that Israel has already vaccinated 61.18% of its population, Chile 37%, the United States 33%, Peru 2%.

Bill Gates, who has inside information, has said he should be surpassing COVID 19 by the end of 2022. Of course, he is thinking of developed countries. That phrase for Peru means 2024.

Our hypothesis is that emerging countries, such as Peru, have little chance of successfully dealing with any pandemic if they do not achieve a plan to achieve a per capita PBI over $30,000, a developed country IDH, that their exports be of differentiated products, where qualified researchers are one thousand per million, accredited by CONCYTEC and the resources for research exceed 1000 dollars per person.

II. Methodology

Since 1993, we have observed and accumulated information on research resources, for education, by country, making statistical relations between the variables of analysis.

Data have been collected for the year 2006 compared to 2019, although there are 13 years of difference to assess that the reality has changed very little [1]. The World Bank, datosmacro.com, [7], the National Council for Science and Technology (CONCYTEC) [8] has been used to observe levels of explanation of the number of researchers and investment in I&D, in addition to locating relationships between variables.

Variables have been grouped in annual PBI, in current terms, the number of universities by country, Human Development Index (IDH), PBI per capita, Per capita Expenditure Education, in dollars, Education Expenditure (millions), Exports (millions), Research (millions), research in science and technology per person (invCTporpers), Researchers per million inhabitants, indexed publications (Scopus) [8] per 100000 inhabitants.

How many researchers per million are there in Peru? Although in the CONCYTEC portal it can be read by March 31, 2021, that 5942 people have been qualified in the segments of Maria Rostorowski and Carlos Monge, and with that data, the location of Peru in the World Ranking is achieved. The Pearson correlation and determination coefficient is used.

III. Results

Stage 1. (2006): In 2006, four variables were analyzed: investment in I&D, PBI, exports, and the number of universities by macro-region of the world.

What was the situation in 2006 about the reality to be investigated? Gross domestic product per capita is vital for development. And it comes from the wealth generated by countries. Thus, North America had 47.5% of the world's wealth, followed by the Asia Pacific with 25.5%, in third place, Europe with 19.7%, Latin America with 5.9%, and Africa with 1.3% of the world's wealth. This means that Europe has a GDP of 4.5 trillion, North America 11 trillion, Asia Pacific 5.9 trillion, Latin America 1.37 trillion, Africa 0.3 trillion, with a world total of 23.2 trillion dollars.

In the world, in 2006, the region that achieved the best universities in the world was Europe. So of the first 500, she had 207, then there was North America with 189 universities, the Asia Pacific got the third place with 92 universities, Latin America only got 7, and finally Africa with 5 universities. It should be noted that, among the top 20 universities, North America had 17, or of the top 100 58 were from North America, so, when the top 200 universities were counted, North America had 95 universities. And in the first 400 and 500 Europe regains its first place. It should be noted that the best universities are concentrated in the United States.

In 2006 (Table I), which is based on [9] [10] [11], 7.5 trillion were exported in the world, and 36% were concentrated in Europe with 2.7 trillion, North America with 29% representing 2.2 trillion. The Asia Pacific had 28% with 2.1 trillion, Latin America with 5% with exports worth 375 billion, and Africa with 2% of total world exports.

It can be assumed that developed country exports differ from emerging country exports; while some export sophisticated products and others export raw materials [12]. And they are sophisticated products because there is a strong investment in research and development to achieve goods and services of high productivity and effectiveness with prices that allow selling volume with decreasing prices.

Over time, North America has achieved a higher percentage of investment in I&D. Thus in 1994 the investment in C&T represented 35.1% and in 2003 it was 41.9%. However, Europe decreased, from 30.6% to 28.2%, also the Asia Pacific regions from 31.3% to 27.3%, and Latin America from 1.6% to 1.3%, and Africa plus Oceania from 1.4% to 1.3%.

The results (Table II), the correlation coefficient of the variables analyzed indicates that, between the number of universities by region and the level of exports, is 0.94, meaning that the regions that have more universities than their exports are greater and vice versa.

TABLE I. List of Variables for 2006

Continents	Univer (a)	Expor(b)	PBI Real(c)	InverI&D (d)	PBI EST (e)
Europe	207	2701	4591	242	6511
North America	189	2178	11057	360	9549
Asía Pacific	92	2100	5932	234	6305
Latín America	7	375	1377	11	562
África	5	150	300	2	330

TABLE II. Correlation Coefficient

	Univer	Expor	PBI	InverID
Universities	1.00	0.94	0.78	0.91
Exports	0.94	1.00	0.74	0.91
PBI	0.78	0.74	1.00	0.95
I&D investment	0.91	0.91	0.95	1.00

On the other hand, there is a high and significant relationship between the number of universities per region and investment in I&D, which is 91%. It turns out that PBI is associated with 95% investment in research and development, which is high and determining since it informs us that the greater the investment in I&D the greater the PBI (wealth). Likewise, the regions that have greater exports are related to the regions that invest more in I&D, this is 0.95 or 95%. Countries that invest little in I&D then their exports are smaller. And they export raw materials or very little differentiation.

When it is assumed that the dependent variable is prestigious universities, understand by internationalized [13] as part of the world, with a global or global vision, this depends on the following three variables: world exports, global PBI, and the resources allocated for research and development. This is deduced because the Pearson correlation exceeds the 74% that is high.

The ratio of wealth generated to investment in research and development, by region in the world, is 90%. All this refers us to [14] which maintain that in A.L. despite the efforts of science in recent years has not given levels of satisfaction. There is no doubt that it could be improved, but for the time being, these are the results that can be observed.

In the Econometric Analysis 2006, based on the calculation in the Eviews Software, you will find the following model that explains the behavior: PBI = 278.955900199 + 25.7505541802*R&D investment. That informs us that the level of explanation or R squared is 0.906 that the investment beta has a p-value of 0.01 that makes it very significant. In addition, the DW is 2.57 which is on the margins of 2. It is a model that explains that the size of the wealth of regions depends up to 90% on investment in I&D. It indicates the relationship between the behavior between the historical series and that calculated by the equation, which will allow us to affirm that in history the levels of explanation of I&D, if it is related to the levels of wealth in the world (2006).

One question, what is the elasticity of investment in I&D, in PBI growth by region? The statistical evidence indicates, the impact is, if investment in I&D increases by 10%, then wealth grows by 6%; and in that way proportionally. The model is: Log (PBI)= 5.46+ 0.6047* log (I&D inversion) with the p-value for the coefficient of the variable is 0.0037 which signals that the coefficient is significant.

And with a Prob (F-statistic) of 0.0036 that indicates that the model is acceptable.

It is confirmed that the levels of economic growth should be higher than the growth of the SAP. With appropriate levels of technology and high productivity, it can enable improvements in the IDH [15] of citizens within a jurisdiction.

Therefore, economic growth is a good reason, as it happened in China, which, with rates between 7% and 11%, [16] has managed to raise its PBI per capita from 1000 (1999) to 10 thousand euros in 2019.

State policies, prioritizing production, education, research, exports of sophisticated goods, the optimization of resources, and maximum productivity, could aspire to the development of our country. The author Quinde [17] carried out the mathematical analysis of the relationship between PBI and expenditure in science in Latin America, between the years 1990-2015, it turns out that for A.L. there are no levels of explanation or relationship but if for the country of Ecuador. To perform the demonstration, it uses the Granger causality test, cointegration, and the unit root test.

How was 2019?

13 years later. The ranking of researchers by countries of the world is associated with the ranking of PBI generated, at the top are the developed countries. In the world, there are TOP-countries in research, those that carry out average research, and countries that do little and little research [3] translated into scientific articles, patents, and innovations.

This is a strong correlation between the number of researchers per million inhabitants (NIPMH) per country and the PBI per capita. The number of scientific articles produced per 100,000 inhabitants to (NIPMH) per country. In (Table III) it is observed that in the first column there are 37 countries, in the second column the number of universities per country in the first 1000 in the world. Then comes the pc PBI. All of the following values are measured in euros. Except for the IDH. Looking at the averages of the variables exposed, it is observed that the maximum data for Peru are well below the world average.

At the end of 2020, Peru had 181 researchers per million inhabitants [12]. Perhaps they should be a little overjoyed, given that below Peru, there are, for example, India with 137 per million, Colombia 126, Bolivia 120, Paraguay 71, and Ecuador 69 per million. But at the same time, it should be worrying, that Israel, according to [10], has 8250 researchers per million inhabitants, and Finland, Iceland, are above 7305 per million inhabitants. The case of Singapore, Denmark, Japan, Norway, Sweden, which are above 5200 researchers per million inhabitants, then the United States, the United Kingdom, Canada, Australia, which are above 4200 researchers per million inhabitants, would be Portugal, Germany, France, Switzerland, Belgium, Ireland with more than 3000 researchers per million and the block of Spain, Hungary, Poland, Italy, and China with more than 1000 researchers per million, also Argentina, Chile, Brazil, Cuba, Mexico, above 300 per million and then there would be Venezuela, Peru, India, Colombia, Bolivia, Paraguay, Ecuador above 69 per million but below 187 researchers per million.

Among the results, (Table IV) it can be noted that there is a positive relationship between wealth (PBI) of 37 countries and investment in (I&D) in 2019. In that sense, an R of 0.983 was found, a very valuable relationship, that if countries have greater wealth then they would allocate in absolute terms a greater portion of resources for research. And vice versa to lower PBI then investment in (I&D) will be lower. Another of the results (Table V) is the positive and very high relationship between the NIPMH and PBI pc (0.7); with per capita expenditure on education (0.74); with investment in (I&D) pc (0.828) and a positive relationship with publications per 100 thousand people in Scimago. In the same way, the scientific production measured by Scimago in the analyzed countries is related to their PBIpc (0.916) with the level of exports (0.642).

It is also imperative to note the number of universities per country is related and explains the investment in (C&T) per capita by country. Here the R2 is 0.904 and the R of Pearson is 0.951, the higher investment, the greater number of universities ranked within the first thousand in the world. Similarly, spending on education correlates with the size of wealth per country with a fairly significant Rho of 0.9934. Here, Wagner's law seems to be adhered to, that the larger the size of the economy, the greater the public spending on education.

Universities are innovation center's that interpret productivity as the ultimate goal for competitiveness, [18] in that sense it has been found that the number of universities per country is related to export levels per country. They are the patents and research in science and technology that allows greater exports or vice versa greater number of universities in the world. Here the Rho is 0.843 is significant.

Indeed, the number of universities within the first thousand in the world is related to their respective PBI of the country. The Pearson Rho is 0.969. It means that if the PBI is high then the number of universities will also be high. It has been stated that exports of raw materials and sophisticated goods are one thing. It should be understood that developed countries or countries with a PBI above 30,000 dollars' per capita export sophisticated goods unlike countries of the second or third world. In this sense, it should not be overlooked that exports by country are significantly related to education spending by country. The Rho is 0.825 quite high and direct. It could not be overlooked that I&D investment, research aims at differentiating products and services that make raising productivity improves competitiveness levels thus achieving a greater share (%) of the markets, the relation with exports is 0.8.

TABLE III. RESULTS PER UNIT

Countries	Univ	IDH	PBI pc	Expenditure pc Education	Exports pc	Rese-arch pc	Researchers per million	Scimago for 100000
Israel	7	0.919	39698	2070	5768	1928	8255	4451
Corea del Sur	32	0.916	28472	2748	18871	2755	7980	2315
Finlandia	8	0.938	43570	2864	11875	1206	7707	6508
Singapur	4	0.938	58934	2293	61194	1130	6088	5568
Austria	14	0.922	44780	2368	17929	1416	5733	4696
Dinamar-ca	6	0.94	53760	3658	16997	1644	5670	7314
Japón	40	0.919	35888	1069	4994	1173	5573	2293
Noruega	5	0.957	67730	5549	17088	1397	5468	6327
Suecia	14	0.945	46160	3567	13887	1534	5239	6817
EE.UU.	206	0.926	58485	2497	4475	1655	4663	3909
Reino Unido	65	0.932	37770	2138	6263	647	4269	5544
Canadá	28	0.929	42048	1895	10505	643	4260	4939
Australia	34	0.944	48969	2375	9495	902	4224	5837
Portugal	6	0.864	20740	898	5823	284	3799	3243
Alemania	49	0.947	41510	2048	15999	1282	3532	3875
Francia	30	0.901	35960	1935	7575	793	3496	3341
Suiza	14	0.955	76200	3853	32623	2559	3436	8880
Bélgica	8	0.931	41460	2653	34645	1166	3435	4945
Irlanda	5	0.955	72260	2358	30514	825	3090	4474
España	40	0.904	26430	1103	6303	326	2944	3147
Rusia	11	0.824	10346	343	2549	102	2784	819
Malasia	5	0.81	9380	418	6542	134	2397	999
Polonia	8	0.88	13870	662	6214	170	1623	1872
Italia	46	0.892	29660	1140	7978	420	1616	3155
Irán	12	0.783	4586	175	591	38	1475	698
Turquía	11	0.82	8230	345	1820	24	1379	769
Tailandia	4	0.777	6307	251	3159	61	1350	286
China	144	0.761	9180	348	1594	200	1307	471
Argentina	3	0.845	9028	505	1294	48	980	501
Chile	4	0.851	13457	714	3258	47	833	856
Brasil	22	0.765	7562	470	946	95	694	489
Egipto	5	0.707	2231	69	257	15	687	229
México	2	0.779	9090	373	3223	28	353	272
Pakistán	4	0.557	1326	40	100	3	336	85
Perú	0	0.777	5933	218	1310	8	181	91
India	15	0.645	1741	62	212	11	137	137
Colombia	1	0.767	5801	250	700	14	126	227

TABLE IV. CORRELATIONS

	Annual PIB	Universities	Education expenditure (millions)	Exports (million)	I&D Invest. (millions)
Annual PIB	1	0.969	0.993	0.843	0.983
Universities	0.969	1	0.973	0.843	0.951
IDH	0.04	0.134	0.074	0.095	0.123
PBI Per cápita	0.119	0.175	0.151	0.1	0.196
Per capita expenditure on education	-0.037	0.024	0.008	-0.062	0.032
Expenditure on education (million)	0.993	0.973	1	0.825	0.982
Exports (in millions)	0.843	0.843	0.825	1	0.8
Research (in millions)	0.983	0.951	0.982	0.8	1
Researchers per million inhabitants.	0.042	0.102	0.06	0.034	0.143
Documents Scimago per 100000	-0.044	0.052	-0.004	-0.027	0.02

TABLE V. CORRELATION OF PEARSON WITH 37 DATA

	University	PBI pc	Gasto pc education	Exportpc	Investigation I&D pc	Imvest por million hab	Scimago for 100000
Gasto pc education	.073	,899	1	,602	,826	,740	,904
Sig. (bilateral)	.668	.000		.000	.000	.000	.000
Export pc	-.137	,710	,602	1	,563	,487	,642
Sig. (bilateral)	.419	.000	.000		.000	.002	.000
Investig. (I&D) pc	.181	,784	,826	,563	1	,828	,759
Sig. (bilateral)	.284	.000	.000	.000		.000	.000
Imvest por million hab (NIPMH)	.102	,702	,740	,487	,828	1	,730
Sig. (bilateral)	.549	.000	.000	.002	.000		.000
Scimago for 100000	.052	,916	,904	,642	,759	,730	1
Sig. (bilateral)	.759	.000	.000	.000	.000	.000	

One IDH input is per capita PBI. And the latter is directly and highly related to per capita spending on education, which confirms that countries that have achieved levels of development allocate more budget for education in their respective countries. So Pearson's Rho is 0.879 confirms our hypothesis.

Models have been generated that allow us to understand, what depends on the number of researchers per million people, an explanation was found. The (NIPMH) depends on PBI and research investment as a percentage of PBI. Researchers per million = 1288.34537675 + 2.7812350751*I&D investment per person. R2= 0.6535, (0.0004) (0.0000) Dw (1.0298).

Now, what does the recorded scientific output in [8] per country depend on? The software has generated the following: Scientific production = 24.4+ 0.0544*PBIpc + 0.9968*GpcED. (R2= 0.8949, (0.9159) (0.0002) (0.0001) Dw (2.075951)) means that the articles published by 100 thousand in the world and accredited by [8] are explained by the PBI and per capita expenditure on education. And as you know these depend on the size of public spending that depends on the wealth of each country.

The next question has also been asked, what does investment in research and development depend on? And it was found, that it depends on the wealth by country (PBI) of the quality of life (IDH) and the of course sophisticated exports made by the country. I&D investment = -85005.2962607 + 0.0295136063527*PBI + 95633.8393054*IDH - 0.0266531438077*EXPOR. R2= 0.9779, (0.001) (0.000) (0.0013) Dw (2.1916).

And the last concern was, what does the size of a country's wealth depend on with the proposed 10 variables? It was determined that it depends on education spending, and levels of I&D investment. PBI = -2876.20676559 + 18.8401561792*GEDUCA + 8.02960074926*Inves (I&D). R2= 0.9887, (0.9458) (0.0000) (0.028) Dw (1.6097).

It means that the creation of wealth depends on the expenditure in education by country and the investment in I&D and explains it in 98.87%.

Algorithm analysis K means. When performing the algorithms (Fig. 1) it is observed that there are three groups with quasi-similar characteristics by the observation of data.

Fig. 1 shows the 37 countries analyzed. With the software, they were grouped into three clusters. So in the conglomerate, one country remained 16, in the two, 17 countries and in the three, four countries. It can be observed that group two includes Peru and most Latin countries, which are emerging countries.

This conglomerate includes Portugal, Russia, Malaysia, Poland, Iran, among others. It should be noted that in cluster one are developed countries and in group three are Norway, Switzerland, Ireland, and Singapore. (Table VI) This last conglomerate stands out for occupying the first places in PBI per capita, in the human development index, in exports per person, which means that there are respectable reasons to accept conglomerates. Similarly, the countries of the second cluster have similar indicators and are in the last places in the ranking. The number of countries per cluster is summarized in (Table VII).

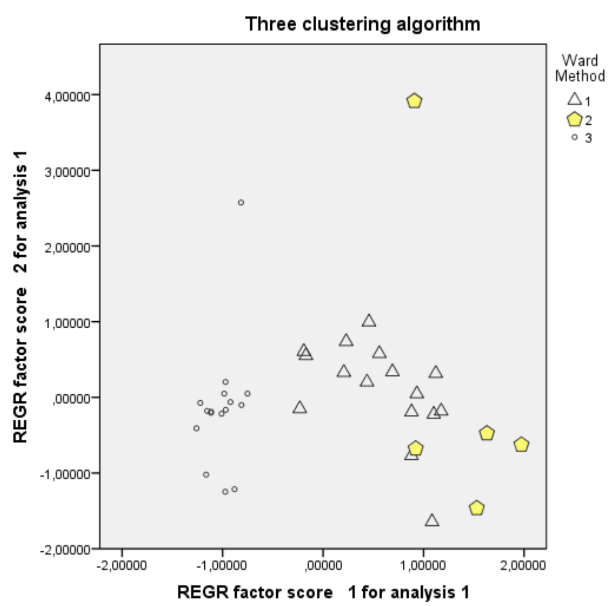

Fig. 1. Three Final Clusters.

TABLE VI. CLUSTER OF RELEVANCE

Case	Conglomerate clusters		
	Countries	*Cluster*	*Distance*
1	Israel	1	7298
2	Corea del Sur	1	14757
3	Finlandia	1	4364
4	Singapur	3	27735
5	Austria	1	7050
6	Dinamarca	1	14117
7	Japón	1	9096
8	Noruega	3	18434
9	Suecia	1	6140
10	Estados Unidos	1	19173
11	Reino Unido	1	6755
12	Canadá	1	2202
13	Australia	1	8594
14	Portugal	2	13558
15	Alemania	1	4244
16	Francia	1	6985
17	Suiza	3	8459
18	Bélgica	1	22609
19	Irlanda	3	6536
20	España	1	15855
21	Rusia	2	2705
22	Malasia	2	4555
23	Polonia	2	7019
24	Italia	1	12584
25	Irán	2	3993
26	Turquía	2	549
27	Tailandia	2	2087
28	China	2	1292
29	Argentina	2	1389
30	Chile	2	5399
31	Brasil	2	1611
32	Egipto	2	6332
33	México	2	1603
34	Pakistán	2	7279
35	Perú	2	2733
36	India	2	6878
37	Colombia	2	3106

TABLE VII. NUMBER OF CASES IN EACH CLUSTER

Cluster		
Clúster	1	16,000
Clúster	2	17,000
Clúster	3	4,000
Valid		37,000

IV. DISCUSSION

The results argue that it is essential to generate wealth (PBI), to have an impact on intense expenditure on education and research, and a human capital with an attitude to propose to carry out scientific research manifested in the records of [8], which allows for greater and better exports [19] with higher.

They argue that the provision of professionals and technicians with relevant training is the crux of making economic development and quality of life sustainable, [20] (P.4) which is one of the elements in the global era of science and technology. Similarly, the World Bank [21] in 1999 noted that development is related to knowledge-based on human capital.

Another of the works that encourage to point out is when the economic resources are vital for the production of knowledge whether laboratory, or not experimental, is the one that demonstrates [22] when it states that the adequate remunerations are related to the production of knowledge.

It was not for less, since, if there are financial resources, economic, equipment, laboratories it is possibly better and more research. The relationship with the acquisition of software is highlighted, demonstrating the importance of this input. (A: 0.999). Another aspect to be taken into account is when UNESCO demonstrates and highlights the role of the institutions, their speed, their vocation, their long-term perspective to improve the elaboration of knowledge. The author in [23] (P.1), one of the determinations assumed by the author [24] is the scientific gap between countries unequal in material wealth. For the author, economic inequality and institutional factors allow for a greater gap. Per capita support is far less than decent in countries with moderate and low wealth, and skilled human resources are still a critical mass in the making. In the case of Peru, the Renacyt researchers as of March 31, 2021, are 5942.

Inequality in Latin America is increasingly difficult. Those who have managed to concentrate wealth are a smaller percentage of the population; today you can say that they define media policies, norms, and long-term policies.

It has been said that the best way to measure this situation is with the Lorentz curve [25] that designs us that decile of society has the greatest percentage of national wealth.

Discounted investment due to depreciation should be considered higher in the next period to emphasize the growth of the economy and move towards a welfare state as supported by the Harrod Domar model. That is the ingredient that long-term policies must have, for investment, and when domestic savings are lacking, then external savings must be attracted. In Peru, in reality, the pandemic has, for the time being, weakened the possibility of achieving greater human capital and of ensuring that research spending is minimal, even painful. COVID 19 has exposed the reality of research in the so-called emerging countries, today the so-called developed countries demonstrate that they are in the capacity to create the vaccine, to do experimental research, and to finance it, while the vast majority, if not 193 of the 200 countries of the world, cannot produce it because they do not have the human capital, the necessary resources and the solvency that experience gives. In any case, technology decides the leading role that imposes conditions. The global economic structure points out those countries in the second and third world must wait for vaccines to arrive. It is proven that the production function is corroborated again and again in China, Singapore, Taiwan, North Korea, Israel, England, Germany, USA, which are examples of the technological progress that makes faster the cumulative process of capital that generates social benefit.

In this regard [26] supports how the University of Concepción (Chile) contributes with competitive human capital, in the creation of knowledge and contribution to regional development. Chile is coping better with the pandemic.

Another work that comments on the role of universities is that of [27] who shows that actions with a view to development objectives take effect. The number of actions or activities contributed between 2016 and 2020 was 3329. Then the new production of goods and services is enriched by the application of the scientific research method to give validity and/or contribute to science and technology.

Gary Becker, has analyzed different forms of investment in the professional working in the company, in training, training, workshops, specialization and has obtained different results, [28] but all positive. The difference is in impact. [29], argue that investment in assets generates externalities that drive the economy, so that all investment is important, which is very little applied in emerging countries, and what at one stage was not considered to be the most appropriate, corrects economist Robert Lucas when he ratifies the performance of investment to generate more production, in the long run, and to grow productivity [28] is a complicated but necessary issue.

The impact of investing in human capital (CH) and its effects on the economy was measured by economist Lucas [30], and he found that if investment in CH increased by 10%, then the output would grow by 4%. For this, developed countries inject immense resources into research and thus confirm the elasticity found is 0.4. Although the world power, U.S. with the experience they have, the state funds the impulse in education. There can be no better example than this for emerging countries when they should fund research and the preparation of scientific tables. Providing support to accredited researchers, they do not yet do so. The data in this document shows this. Another contribution that can be derived from this work is the positive externalities that the experienced human capital contributes.

In that same direction is the contribution of [31] when it finds that if it increases by ten percent in research and development then the product would increase by between 0.6 and one percent. This is confirmed by the investigator [32]. Another author is Solow, [33] who developed the theoretical basis for explaining the factors that contribute to economic growth. The contribution was based on the technological advance and that generates the so-called aliquot of Solow, that there is a part of the economic growth that only explains it the technological advance. [34]. Experience, education, technology per person. The equation [35] was generated in application to the period between 1909 and 1949 where there were differences between the incremental rates of PNB, man-hour, and the capital factor in the period.

Thus the so-called residue was obtained. It happens that in the period the product had grown by 100%, and that the capital per worker explained 12% of that difference while the remaining 88% was explained by the technological progress. This was confirmed by Denison when analyzing the variables mentioned in the period 1929 to 1982 [36], thus also showing that education contributes to the increase of goods and services. Another argument is when the training and training provided by the company allow productivity to increase per worker [29].

At the national level from this perspective, the renowned educator has spoken [37] who with their experience defines that research has a leading role in generating knowledge but at the same time promotes methodologies and patents for increasing productivity, In that understanding, the new university law of the year 2014 rectifies the delivery of the bachelor degree without thesis.

For the same reason that it allows the generation of researchers qualified by CONCYTEC [24], the proposal is to publish in journals with peer reviewers [38]. Does a strategic direction for the development of scientific production become necessary? Of course, yes. This has to do with financing, human capital, researchers, organizational design. [39] the only way to see results in the long term. Soria adds that they can be defined as state policies [40].

V. Conclusion

It is shown that investment in I&D has a positive relationship with higher PBI and this fulfills its cycle with greater scientific research, and vice versa.

The analysis of mean K determines three groups with dissimilar characteristics, based on per capita PBI, the human development index, per capita investment in research, and per capita exports. It is understood that group three countries, Switzerland, Singapore, Norway, and Ireland lead these indicators, group two being developing countries while cluster one being developed countries.

The long-term structure indicates that the circumstances have not changed in the two analysis periods, 2006 and 2019.

The educational model implemented in the conglomerate requires generating greater wealth (PBI) to guarantee the quality of life (IDH). It is necessary to implement expenditure on education and scientific research in absolute terms.

The largest number of universities per country are concentrated where there is higher spending on education, higher investment in I&D, where PBI is higher, where exports are differentiated products. The problem of Peru is structural and it is defined that it will be so, as long as the per capita is less than 30 thousand dollars.

VI. Future Work

Future work will focus on comparative analysis of the behavior of the first and second waves of covid-19, a proposed model with reviews software and 2020-2021 algorithms.

Effects of the COVID-19 coronavirus on employment, family income, and digital education in Peru, 2020 - 2021 using econometric models.

Algorithms that explain the effects of COVID 19 on tax collection, private and public investment in Peru 2021.

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